Date: Thursday, 05/02/2009 8:17:52 AM
User: Chantal Lavoie

Process Sheet

Customer	: CU-DAR001 Dart Helicopters Services	**Drawing Name**	: T-BEAM EXTRUSION
Job Number	: 45500		
Estimate Number	: 10043		
P.O. Number	:	**Part Number**	: D6201
This Issue	: 05/02/2009 **S.O. No.** :	**Drawing Number**	: D6201 REV A
Prsht Rev.	: NC	**Project Number**	: N/A
First Issue	: / / **Type** : PURCHASED PARTS	**Drawing Revision**	: A
Previous Run	: 43959	**Material**	:
Written By	:	**Due Date**	: 12/02/2009 **Qty:** 20 **Um:** F
Checked & Approved By	: CL09/02/05		
Comment	: Est. A: 01.05.15 New Issue EC		

Additional Product

Job Number:

Seq. #:	Machine Or Operation:	Description :
1.0	PG	PURCHASING

Comment: PURCHASING
Issue P/O: 8205 CL09/02/17 20ft
a)Description: T-beam extrusion
b) 4.00" x 4.00" x 0.375"
c) Minimum Ultimate Tensile Strength = 38ksi
d) Minimum Yield Tensile stength = 35ksi
e) Material: 6061-T6/T6511 (QQ-A-200/8) ASTM B308 09.02.09
f)Material certification required

2.0	D6201P	T Extrusion 4X4X3/8

Comment: Qty.: 1.0000 f(s)/Unit Total : 20.0000 f(s)
T Extrusion 4X4X3/8

3.0	PACKAGING 1	PACKAGING RESOURCE #1

Comment: PACKAGING RESOURCE #1
Receive & Inspect For Transit Damage
Ensure material certification is attached 09/2/20 (20)

4.0	QC6	DIMENSIONAL CHECK

Comment: DIMENSIONAL CHECK
Ensure Material certification comply to Dwg D6104 20'

Dart Aerospace Ltd

W/O:		WORK ORDER CHANGES					
DATE	**STEP**	**PROCEDURE CHANGE**	**By**	**Date**	**Qty**	**Approval** Chief Eng / Prod Mgr	**Approval** QC Inspector

Part No: D6201 **PAR #:** _____ **Fault Category:** _____ **NCR:** Yes (No) **DQA:** D **Date:** 09/02/23

Resolution: _____ **Disposition:** _____ **QA: N/C Closed:** _____ **Date:** _____

NCR: 45500		WORK ORDER NON-CONFORMANCE (NCR)						
DATE	**STEP**	**Description of NC** Section A	**Corrective Action** Section B			**Verification** Section C	**Approval** Chief Eng	**Approval** QC Inspector
			Initial Chief Eng	**Action Description** Chief Eng	**Sign & Date**			
09.02.23	3	THICKNESS AS LOW AS 0.362" IN SOME LOCATIONS	09.02.23 per QSI 042	Acceptable. MARGINS STIL POSITIVE PER ATTACHED STRESS REPORT		09.02.24	09.02.23 per QSI 042	09.02.24
	3	HIGHT OF 'T' IS 3.982".	09.02.23 per QSI 042	Acceptable. TAG material to require ENG approval on parts made from mat'l. Zero setting may	09.02.24	09.02.24	09.02.23 per QSI 042	09.02.24
				have to be adjusted on CNC to ensure top edge distances maintained.				

NOTE: Date & initial all entries

Date: Thursday, 05/02/2009 8:17:52 AM
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Process Sheet

Customer: CU-DAR001 Dart Helicopters Services **Drawing Name:** T-BEAM EXTRUSION

Job Number: 45500 **Part Number:** D6201

Job Number:

Seq. #:	Machine Or Operation:	Description :
5.0	PACKAGING 1	PACKAGING RESOURCE #1

Comment: PACKAGING RESOURCE #1
Identify and Stock
Location: CNC

09.02.24 20

6.0	QC21	FINAL INSPECTION/W/O RELEASE

09/02/24

Comment: FINAL INSPECTION/W/O RELEASE

Job Completion

MF 09.02.24

Form: rprocess

Dart Aerospace Ltd

W/O:		WORK ORDER CHANGES					
DATE	**STEP**	**PROCEDURE CHANGE**	**By**	**Date**	**Qty**	**Approval** Chief Eng / Prod Mgr	**Approval** QC Inspector

Part No: _____ **PAR #:** _____ **Fault Category:** _____ **NCR:** Yes No **DQA:** _____ **Date:** _____

Resolution: _____ **Disposition:** _____ **QA: N/C Closed:** _____ **Date:** _____

NCR:		WORK ORDER NON-CONFORMANCE (NCR)						
DATE	**STEP**	**Description of NC** Section A	**Corrective Action** Section B			**Verification** Section C	**Approval** Chief Eng	**Approval** QC Inspector
			Initial Chief Eng	**Action Description** Chief Eng	**Sign & Date**			

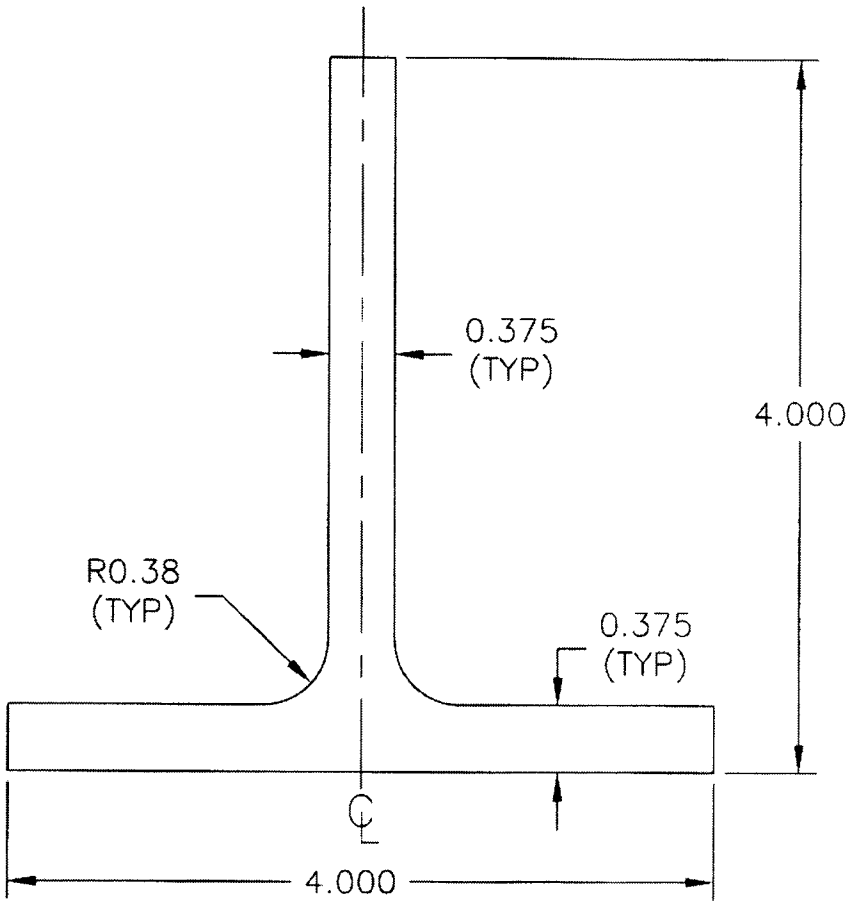
NOTE: Date & initial all entries

DESIGN CP	DRAWN BY CP	DART AEROSPACE LTD HAWKESBURY, ONTARIO, CANADA	
CHECKED	APPROVED	DRAWING NO. D6201	REV. A SHEET 1 OF 1
DATE 01.04.10		TITLE T-BEAM EXTRUSION	SCALE 1:1
A	01.04.10	NEW ISSUE	

SPECIFICATION CONTROL DRAWING

RELEASED
01.04.23

SHOP COPY
RETURN TO
ENGINEERING
UNCONTROLLED COPY
SUBJECT TO AMENDMENT
WITHOUT NOTICE
WORK ORDER
NO. 45500



D6201-XXX T-BEAM EXTRUSION
WHERE XXX IS LENGTH IN INCHES

EG.
D6201-027 IS 27 INCHES LONG

PURCHASE MATERIAL: ALUMINUM "T"-EXTRUSION ROUND FILLET
4.000" x 4.000" x 0.375"
6061-T6/T6511 (QQ-A-200/8)
MINIMUM ULTIMATE TENSILE STRENGTH = 38 ksi
MINIMUM YIELD TENSILE STRENGTH = 35 ksi

TOLERANCES ARE PER DART QSI 018 UNLESS OTHERWISE NOTED

PANASIA ALUMINIUM (CHINA) LIMITED

Aluminium Mill Certificate

Cert. No.: PAAV-MC0703036

OK 09.02.23

CUSTOMER: Magna Stainless Inc

PO No.: 065464-JC
Contract No.: NIL

Alloy & Temper: 5061-T6511
Standards: ASTM-B308
QQA-200/16

Container No.: ZCSU9010606
Date of shipment: 2007.03.12

BW-550

Chemical Composition (%)

Heat No.	Si	Mg	Fe	Cu	Mn	Zn	Cr	Ti	Al
Standard	0.40-0.80	0.80-1.20	0.7max.	0.15-0.40	0.15max.	0.25max.	0.04-0.35	0.15max.	Rem.
20070306401	0.469	0.890	0.242	0.194	0.026	0.038	0.047	0.018	Rem.

Tensile Test Result

Heat No.	Die No.	Customer part No.	Description	Tensile Strength		Yield Strength		Elongation
				N/mm²	Ksi	N/mm²	Ksi	%
				260min.	38min.	240 min.	35min.	10 min.
20070306401	C10000071		Channel 6x2.5x0.25	280	41	255	37	11.0
20070306401	E10000004		Tee 4x4x0.375	285	42	255	37	10.8
20070306401	C10051		Channel 4x2x0.187	290	42	265	39	10.9

Hardness Test Result

Section No.	HRE	Webster	Other Remarks
C10000071	91	15.6	
E10000004	94	16.2	
C10051	92	15.9	

The above result was done on testing samples and the mill shall guarantee the same quality for the same batch of products. It is certified that this material conforms in all respects to the requirements of the above standards latest revision.

QC: Chenghao Zhong

Checked by: Junxian Luo

品管部

EXCERPT FROM ST2341 Rev. A

09.0223

Margins still positive with t = 0.362 in WALL THICKNESS

Litter Tie Down Bracket (Locking)

Wt := 203.61 lbs		Weight of brackets, individual and rack.
Fwd := 4	g's	Forward Force
Sde := 2	g's	Sideward Force
Dwn := 4	g's	Downward Force
Upwd := 1.5	g's	Upward Force
SF := 1.5		Required Safety Factor

Shear Tear Out (Sideward Force)

Specifications:

Ftu := 42000 psi — Bracket Material Ultimate Strength

$Pds := SF \cdot Wt \cdot Sde \cdot \left(\frac{2}{3}\right)$ — Design Load

Pds = 407.22 lbs

Dimensions:

DIA := 0.191 in — Hole Dia

d := 0.3455 in — Distance from Centerline to outer edge

t := .362 in — Material thickness WAS 0.375 in

As := t·d — Area of Shear Out

Shear Load:

Pu := Ftu·As·2

$Pu = 1.051 \cdot 10^4$ lbs — Ultimate Load

Margin of Safety

$MS := \frac{Pu}{Pds} - 1$ — MS = 25

MS27039-1-15 Bolt Shear (Sideward Force)

Bolt Specifications:

Ptu := 4250	lbs	Load Strenght of Bolt
Dia := 0.3125	in	Bolt Dimensions
Grip 0.5	in	

Ultimate Load:

A Dia·Grip·2

$Fu \quad \frac{Ptu}{A}$ — Shear Load

$Fu = 1.36 \cdot 10^4$

$$Pds := SF \cdot Wt \cdot Sde \cdot \frac{2}{3}$$

Design Load:

$$Fds := \frac{Pds}{A}$$

$$Fds = 1.303 \cdot 10^{3} \text{ psi}$$

MS=Margin of Safety (Actual)

$$MS := \frac{Fu}{Fds} - 1 \qquad MS = 9.4$$

Litter Tie Down Bracket

Shear Tear Out (Upward Force)

Specifications:

$Ftu := 42000$ psi	Ultimate Strength of Bracket Material
$t = 0.362$ in	Material Thickness
$d := 0.86$ in	Distance from centerline to edge
$No := 4$	Number of Fasteners

$$Pds := \frac{SF \cdot Wt \cdot Upwd \cdot 2}{No \cdot 3}$$ Design Load

$$Pds = 76.35 \text{ lbs}$$

Design Load

$$Area := t \cdot d \cdot 2$$

$$Fds := \frac{Pds}{Area}$$

$$Fds = 122.629 \text{ lbs}$$

MS=Margin of Safety (Actual)

$$MS := \frac{Ftu}{Fds} - 1 \qquad MS = 341$$

MS27039-1-15 Bolt Double Shear (Upward Force)

Specifications:

$Ptu := 1342$ lbs — Bolt Material Shear Strength (Ftu=35ksi)

$Pds := \frac{SF \cdot Wt \cdot Upwd \cdot 2}{No \cdot 3}$ — Design Load

$Pds = 76.354$ lbs

MS=Margin of Safety (Actual)

$MS := \frac{Ptu}{Pds} - 1$ $MS = 16.576$

The following calculations are done on the assumption that the restraining finger acts as a cantilever beam, with a point load acting at the indicated postion upon the diagram.

Bending Stress Calculation

Geometry:

$L := 0.491$ in — Length of Beam
$t = 0.362$ in — Material thickness
$h := 0.485$ in — Height of Material
$Fty := 36000$ psi — Material yield strength (6061-T6)

Calculations:

$Ix := \frac{t \cdot h^3}{12}$ — Inertia about x-axis

$c := \frac{h}{2}$ — Half distance to surface

$M := Pds \cdot L$ — Moment due to force application at shoulder of bracket

$M = 37.49$ lbs*in

$\delta := \frac{M \cdot c}{Ix}$ — Stress at shoulder of bracket

$\delta = 2.642 \cdot 10^2$ psi

Margin of Safety:

$MS := \frac{Fty}{\delta} - 1$ $MS = 13$

ST2363 Rev.A

Litter Tie Down Bracket

Shear and Tensile Stresses:

The following calculations will analyse the shear and tensile stresses upon the forward and aft brackets. It is assumed that the forward bracket will take all of the 4g forward load. In addition, although there exists tension and shear acting at the same time upon the clamps, due to the small loading forces being applied at any one time each will analysed seperately.

Loading Conditions:

$Wt := 203.6$ lbs	Weight of brackets, individual and litter.
$Fwd := 4$ g's	Forward Inertial Force
$Sde := 2$ g's	Sideward Inertial Force
$Dwn := 4$ g's	Downward Inertial Force
$Upwd := 1.5$ g's	Upward Inertial Force
$SF := 1.5$	Safety Factor

Shear Tear Out **(Upward Inertial Force)**

Specifications:

$Ftu := 42000$ psi	Material Strength
$d := 0.484$ in	Edge Dist from Centerline of Hole
$t := .362$ in	Material thickness
$Pds := Wt \cdot SF \cdot Upwd \cdot \left(\frac{2}{3}\right)$	Forward g's and safety factor

Design Strength:

$Area := d \cdot t \cdot 2$ $\quad Area = 0.35$

$Fds := \frac{Pds}{Area}$ $\quad Fds = 871.536$ psi $\quad$ Applied Stress

Margin of Safety:

$MS := \frac{Ftu}{Fds} - 1$ $\quad MS = 47.19$

AN3 Bolt Shear (Upward Inertial Force)

Specifications:

Ptu := 2125 lbs — AN3 10-32 Bolt Material Shear Strength

Pds = 305.4 lbs — Design Load

MS=Margin of Safety (Actual)

$$MS := \frac{Ptu}{Pds} - 1 \qquad MS = 5.96$$

Pip Pin Shear (Sideward Inertial Force)

Specifications:

Ptu := 2300 lbs — Pip Pin Shear Strength

$Pds := Wt \cdot SF \cdot Sde \cdot \left(\frac{2}{3}\right)$ — Design Load

Pds = 407.2 lbs

MS=Margin of Safety (Actual)

$$MS := \frac{Ptu}{Pds} - 1 \qquad MS = 4.65$$

Shear Load: (Single Shear)

$Pds := Wt \cdot SF \cdot Fwd$

$Pds = 1.222 \cdot 10^3$ lbs

$Psu := 2300$ lbs Pip Pin Shear Load

-This is half of the stated value in the manufactures specifications for double shear.

- It is also assumed that the clamps take no shear load.

Margin of Safety:

$$MS = \frac{Psu}{Pds} - 1 \qquad MS = 0.883$$

Tensile Load:

$Ptu := 200$ lbs Pip Pin Tensile Load Specification

$Ptu2 := 2210$ lbs AN3 Bolt Tensile Load Specification

$M_A=0$

$$Prec := \frac{1222 \cdot (2.234)}{3} \qquad Prec = 909.98 \text{ lbs}$$

The Pip Pin was assumed to take no load. Each clamp would sustain 455 lbs which would be more than adaquate.